Part 1. Report Cover

Original Report Number: 00AYP036

Original Report Date: 12 May 00 **Revision Date(s):** N/A

Retest Report Number: N/A **Retest Report Date(s):** N/A

Title: Performance Oriented Packaging Testing of a Grade V3c Fiberboard, Style RSC Box, 12 inches by 12 inches by 16 inches (ID), With 2½-Liter, Round, Glass Bottle (Quantity of 1) for Liquids

Responsible Individual: Francis S. Flynn

Performing Activity: LOGSA Packaging, Storage, and Containerization Center
ATTN: AMXLS-T
11 Hap Arnold Boulevard
Tobyhanna, PA 18466-5097

Performing Activity's Reference(s): TE 35-97;
AMC 13-88

Retest Report Date(s): N/A **Revision Date(s):** N/A

Original Report Date: 18 Mar 98

Report Type: Interim Final

DTIC Distribution: N/A

Requesting Organization(s):

Defense Logistics Agency
Defense Distribution Center
ATTN: DDC-TO
2001 Mission Drive
New Cumberland PA 17070

Requesting Organization's Reference(s):

1. DLA Memorandum, 14 Oct 99

RN: 00AYP036

Part 2. Test Results: ___ single _X_ combination ___ composite

Section I. Pre-test Conditions

For initial testing, a bundle of boxes was received in new condition. Boxes from the lot from which this box was taken have also been performance tested with a variety of bottles and cans.

The following identification schema designates the packaging specimen used for the test(s) indicated. Assignments were made at random, in no particular order of sequence.

Specimen No.	Test
1	repetitive-shock vibration test
	flat onto bottom, drop test
	flat onto top, drop test
	flat onto long side, drop test
	flat onto short side, drop test
	bottom joint corner, drop test
2	stack test
3	water resistance test

Section II. Summary

	SPECIMEN	ALL
A. Drop test - *1.8 m (PG I SG 1.2, PG II SG 1.8, PG III SG 2.7)*		**PASS**
flat onto the top (face 1)	PASS	
flat onto the bottom (face 3)	PASS	
flat onto long side (face 4)	PASS	
flat onto short side (face 6)	PASS	
bottom joint corner (2-3-5)	PASS	
B. Stacking test - *static load, 500 lb, 24 hr*		**PASS**
C. Vibration standard - *repetitive-shock, rotary motion 3.53 Hz., 1 hr*		**PASS**
D. Leakproofness test - *restrained under water/soap over seams*		N/A
production testing, 20 kPa, 5 min.	N/A	
design qualification, 20 kPa, 5 min.	N/A	
salvage drum requirement, 20 kPa, 5 min.	N/A	

E. Internal pressure/Hydrostatic pressure test (liq.) -
95 kPa, ring manufacturer's testamentary N/A

F. Water resistance test (fiberboard box) - **PASS**

G. Compatibility test (liq. in plastics) - N/A

To be certifiable, the configuration must pass the applicable tests for the type packaging, intended lading, and mode(s) of shipment. This report is/~~is not~~ applicable to transportation by air.

Part 2. Test Results (continued)

Section III. Discussion

Note. Numeric designations denote which specimen tested in that orientation.

A. Drop test: *49 CFR §178.603*

___ cold conditioned (0° F, 72 hr)
___ ambient conditions
_X_ standard conditions (50% RH & 23° C)

No	Ht	Orientation	Results
1[1]	1.8 m	Flat onto box bottom	Pass. No leaks/rupture; entire contents retained
1[1]	1.8 m	Flat onto box top	Pass. No leaks/rupture; entire contents retained
1[1]	1.8 m	Flat onto box long side	Pass. No leaks/rupture; entire contents retained
1[1]	1.8 m	Flat onto box short side	Pass. No leaks/rupture; entire contents retained
1[1]	1.8 m	Diagonally onto bottom, joint corner	Pass. No leaks/rupture; minor crushing of the 5-2-3 corner; can retained completely within the box; absorbent material had not settled.

Note 1. Specimen 1, a combination packaging consisting of a grade V3c fiberboard box (outer packaging) containing one 2½-liter, round, glass bottle. The 2½-liter, round, glass bottle was filled with water (SG 1.0) to 98% of maximum capacity (based on weight).

B. Stacking test: *49 CFR §178.606* (conducted under 00AYP040)

_X_ standard conditions (23° C & 50% RH)
___ ambient conditions (~72° F)
___ high temperature conditions (104° F)

No.	Length	Type	Load/Force	Peak Force	Results	Stability Maintained?
2[1]	24 hr	Static	500 lbf	N/A lbf	Pass	Yes

Note 1. Specimen 2, grade V3c fiberboard box, tested empty

C. Vibration test: *49 CFR §178.608*

No.	Frequency	Duration	Results
1[1]	3.53 Hz	1 hr	Pass. No leakage, rupture, or damage

Note 1. Specimen 1, a combination packaging consisting of a grade V3c fiberboard box (outer packaging) containing one 2½-liter, round, glass bottle. The 2½-liter, round, glass bottle was filled with water (SG 1.0) to 98% of maximum capacity (based on weight).

Part 2. Test Results: Section III (continued)

D. Leakproofness test: *49 CFR §178.604*
N/A. Leakproofness testing of inner packagings is not required.

E. Internal Pressure/Hydrostatic Pressure test: *49 CFR §178.605*
Testing for the maintenance of internal pressure is not required for combination configurations for surface modes. See 49 CFR §178.605. For transportation by air, 49 CFR §173.27 applies.

F. Water resistance (Cobb Method) test (fiberboard): As required by the standards for fiberboard boxes (*49 CFR §178.516*), the Cobb Method Test for water absorptiveness was performed on specimens cut from a box (specimen 3) taken from the same bundle as the box used for rough handling (drop, stack, and vibration) testing.

No. specimens felt side (exterior) 5 . Average 116.6 g/m². Standard deviation 3.44 . Highest exterior value was 120 g/m². Lowest exterior value was 112 g/m². All of the samples tested were free of printing.

No. specimens wire side (interior) 5 . Average 127.4 g/m². Standard deviation 9.53 . Highest interior value was 144 g/m². Lowest interior value was 120 g/m².

No. specimens exceeding 155 g/m² 0 .

G. Compatibility test (plastics packagings only): N/A.
The establishment of compatibility is a procedure specified in appendix B to part 173, as required by *49 CFR §173.24(e)(3)(ii),* and is only required for plastics packagings intended to contain liquid hazardous materials.

Section IV. Notes

For this configuration, one of the following can be used without any notable difference in performance:

1) Fine grade vermiculite (CID A-A-52450, Vermiculite, Absorbent (For Packaging Liquid Hazardous Materials))
2) HAZMATPAC® Absorbent A-900
3) Absorption Corporation Absorbent GP

Note: Inner packagings have a tendency to migrate if the loose fill materials is not firmly packed, especially into the box corners.

Part 3. Test Personnel

A. Drop test (*49 CFR §178.603*)

B. Stacking test (*49 CFR §178.606*)

C. Vibration standard (*49 CFR §178.608 and §173.24a(a)(5)*)

D. Leakproofness test (*49 CFR §178.604*) - N/A

E. Internal pressure/Hydrostatic pressure test (*49 CFR §173.27 and §178.605*) - N/A

F. Water resistance standard (*49 CFR §178.516*)

G. Procedure for Testing Compatibility and Rate of Permeation in Plastic Packaging and Receptacles (*49 CFR §173.24, app B to part 173*) - N/A

The personnel who performed the aforementioned testing, or had a role in the testing, evaluation, and/or documentation, as reported herein are recorded in the test files.

Part 4. References

A. Title 49 Code of Federal Regulations, Parts 173 and 178, October 1, 1997 edition

B. International Air Transport Association Dangerous Goods Regulations, 39th edition, 1 January 1998

C. ASTM D 4919, Specification for Testing of Hazardous Materials Packagings

D. ASTM D 999, Standard Method for Vibration Testing of Shipping Containers

E. ASTM D 951, Standard Test Method Water Resistance of Shipping Containers by Spray Method

F. TAPPI Standard: T 441 Water Absorptiveness of Sized (Non-Bibulous) Paper and Paperboard (Cobb Test)

G. Recommendations on the Transport of Dangerous Goods, sixth revised edition, United Nations, New York, 1990

H. DLAD 4145.41/AR 700-143/AFJI 24-201/NAVSUPINST 4030.55A/ MCO 4030.40A, Packaging of Hazardous Material, 23 Jul 96

Part 5. Equipment

Item	Manufacturer	Serial No.	Calibration Expiration Date
6-inch dial calipers	Brown & Sharp Switzerland	599-5794	1/03
1,250-lb vibration table	L.A.B Skaneateles, NY	8120179	*see note*
4,000-lb vibration table	Gaynes Engr. Co. Franklin Park, IL	G20765	*see note*
12,000-lb vibration table	M/RAD Woburn, MA	563-84	*see note*
30,000-lb compression tester	Gaynes Engr. Co. Franklin Park, IL	G20950	4/00
5,000-lb compression tester	L.A.B Skaneateles, NY	1107050	4/00
10,000-lb scale	J.J. McIntyre & Sons Whitehall, PA	5931A	4/00
5,000-lb scale	Fairbanks Scale USA	H519240	4/00
500-lb scale	Toledo Scale Worthington, OH	N/A	4/00
5,000-gram scale	Ohaus Corporation USA	20078	N/A (new)
3,000-gram balance	Brinkmann Instruments	3103120	4/00

	Westbury, NY		
release hook	Gaynes Engr. Co.	18211-1	N/R
	Franklin Park, IL		
drop tester	L.A.B	3811	N/R
	Skaneateles, NY		
cold chamber	Russells	1962214	4/00
	Holland, MI		
altitude chamber	American Research Corp.	5A13622	4/00
	Farmington, CT		
32-channel chart recorder	Molytek, Inc.	870403007-2S	7/00
	Pittsburgh, PA		
Cobb Sizing Tester	Teledyne Curley	4180-A	N/R
	Troy, NY		
30 psi pressure gauge	WIKA Instrument Corp.	961420001	4/00
	Lawrenceville, GA		
100 psi pressure gauge	WIKA Instrument Corp.	961420002	4/00
	Lawrenceville, GA		
torque wrench (150 ft.-lb)	Stanley-Proto	WWE30966	6/00
	Covington, GA		
torque wrench (100 ft.-lb)	Stanley-Proto	WUK50305	7/00
	Covington, GA		
torque wrench (50 in.-lb)	Stanley-Proto	5A98	N/A (new)
	Covington, GA		
torque wrench (200 in.-lb)	Stanley-Proto	WYC22958	N/A (new)
	Covington, GA		
400 kPa pressure gauge	Ashcroft	45323-016A	11/00
	Stratford, CT		
400 kPa pressure gauge	Ashcroft	5323-016B	11/00
	Stratford, CT		
100 kPa pressure gauge	Ashcroft	59694-011B	11/00
	Stratford, CT		
100 kPa pressure gauge	Ashcroft	59695-011A	11/00
	Stratford, CT		
semi-automatic plastic pail	Atlanta Grotnes	44833	N/A
Rieke® Flex Spout 600		15852	N/A

Note. Equipment is calibrated in accordance with International Safe Transit Association test equipment verification requirements.

Appendix A

Test Applicability

Pass/fail conclusions were based on the particular bottle and box specimens, test loads, and the limited quantities submitted for test. Extrapolation to other materials, other manufacturers, other applications, different inner packagings, container sizes, or lesser inner quantities is the responsibility of the packaging design agency or applicable higher headquarters. Extrapolation of test results based on less than the minimum recommended number of test specimens is also the responsibility of the packaging design agency or applicable higher headquarters.

Reference to specification materials has been made based either on the information provided by the requester, the manufacturer, or the markings printed on, attached to, or embossed on the packagings. It was not possible to identify the exact composition of the box construction materials.

Testing was performed per Title 49 Code of Federal Regulations, subpart M of part II.

Performance testing was undertaken and completed at the request of an agency responsible for shipment of the dangerous good(s). The completion of successful required performance tests does not, by itself, authorize the marking and transportation of the dangerous good(s). Applicable modal regulations should be consulted concerning the relationship of performance testing completed and the dangerous good(s).

The required performance tests are intended to evaluate the performance of the packaging components. The criteria used to evaluate packaging performance is whether the contents of the packaging are retained within the outer packaging, should damage to the outer packaging occur, and secondly, if any inner packaging of hazardous materials leaks, ruptures, or is damaged so as to affect transportation safety. The successful completion of the required tests does not ensure the undamaged delivery or survivability of the actual commodity/item. Separate testing is necessary to assure the stability of any explosive item.

Before a configuration can be certified by the person(s) authorizing shipment, the appropriate packaging for the particular hazardous lading and mode of transportation must be determined, and the item(s) must be prepared for shipment per applicable regulations. The chosen configuration must have been performance tested in accordance with the size, the shape, and the weight constraints posed by the configuration to be certified. The testing reported herein should not be construed as blanket certification of any configuration which simply uses the performance tested box. Packaging paragraphs apply.

Appendix B

Test Data Sheet

Section I. Test Product

Name: Water

Physical State: ___ solid _X_ liquid ___ gas ___ aerosol

Amount Per Container (Configuration):
2½-liter, rated
5 lb
7 lb, packed

Gross Weight: 22.2 lb; 10 kg

Density/Specific Gravity: 1.0

Consistency/Viscosity: N/A

Flash Point: N/A

Additional Description: N/A

Section II. Test Parameters

Drop Height: Ref: *49 CFR §178.603*
_X_ **1.8 m**; 71 in. (PG I, II, & III, **SG = 1.2** or solids)
___ 1.2 m; 47 in. (PG II & III, SG = 1.2 or solids)
___ 0.8 m; 32 in. (PG III, SG = 1.2 or solids)
___ ___ m; ___ in. (other, PG ___, SG ___)
from-- _X_ PG I: SG x 1.5 m, SG x 59.06 in.
_X_ PG II: SG x 1.0 m, SG x 39.37 in.
_X_ PG III: SG x 0.67 m, SG x 26.38 in.

Unless otherwise computed for more dense liquids, water (SG = 1) represents a solution having a specific gravity of 1.2 or less. Equivalent specific gravity derived from drop height as follows--

PG factor x density (or SG) = drop height, thus
SG = drop height/PG factor (49 CFR §178.603)
0.67 m x SG = 1.8 m, thus SG = 2.7, PG III

Appendix B (Continued)

Section II. Test Parameters (continued)

Stacking Weight Formula, Liquids – DLA

Variables		Inputs	Calculations	
h	height, drum/box	16		
n	# stacked containers	XXXXXXXX		7.4
w1	weight, drum/box	2.2	2.2	
w2	weight, bottle/can	2.15	2.15	
w3	weight, ring/pad	0	0	
q1	# inner containers	1	1	
v1	max. volume, 1 inner container	2.5	2.5	
v	total volume	XXXXXXXX	2.5	
w4	weight, gross packaging	22.2	22.2	
W5	weight, absorbent	13	13	
W	total weight	XXXXXXXX	17	
C	constant	1		
A1	Stacking weight-PG I	XXXXXXXX		**265**
A2	Stacking weight-PG II	XXXXXXXX		**343.1**
A3	Stacking weight-PG III	XXXXXXXX		**460.2**
A11	Stacking weight, rounded-PG I	XXXXXXXX		**265**
A21	Stacking weight, rounded-PG II	XXXXXXXX		**344**
A31	Stacking weight, rounded-PG III	XXXXXXXX		**461**

NOTE: A1 = (n-1)*(w+(1.2*v*8.3*0.98))*(c), Packing Group I
A2 = (n-1)*(w+(1.8*v*8.3*0.98))*(c), Packing Group II
A3 = (n-1)*(w+(2.7*v*8.3*0.98))*(c), Packing Group III

A1 = stacking weight in pounds, PG I
A2 = stacking weight in pounds, PG II
A3 = stacking weight in pounds, PG III
n = (118/h), minimum number of containers that when stacked, reach a height of 3 m
w = w1+(w2*q1)*(w3*q1)*w5, total weight in pounds
v = v1*q1, total volume
c = either 1.5 (the compensation factor that converts the static load of the stacking test into a load suitable for dynamic compression testing), or 1.0 (static top load)

Appendix B (Continued)

Section II. Test Parameters (continued)

Internal Pressure/Hydrostatic Pressure (liquids only):

Ref: *49 CFR §178.605 and §173.27*

___ N/A; *surface only*
[§178.605(a)]

___ N/A; *solids*
[§178.605(a)]

___ 250 kPa (36 psi); *PG I single minimum*
[§178.605(d)(3), surface & §173.27(c)(3)(ii), air]

___ 100 kPa (15 psi); *PG II/III single minimum*
[§178.605(d)(3), surface & §173.27(c)(3)(ii), air]

___ 80 kPa (12 psi); *PG III of Class 3 or Division 6.1 sgl min.*
[§173.27(c)(3)(ii), air]

_X_ 95 kPa (14 psi); ***inner/supplementary minimum, PG N/A***
[§173.27(c)(2)(i), air]

___ 75 kPa (11 psi); *inner/suppl. min., PG III of Cl 3/Div 6.1*
[§173.27(c)(2)(i), air]

___ 15 psi/103.4 kPa; *other, drum specification*
[MIL-D-6054]

___ ___ kPa/____ psi; *other,* _____

Section III. Equivalencies of Liquids

	Specific Gravity[1]	Total (Each) Amount per Container	Gross Weight (pounds)	Test Weight (kilograms)
water	1.0	8.32 (2.08) lb	22.20	10.1
PG I	1.2	10.00 (2.50) lb	27.20	12.36
PG II	1.8	14.96 (3.74) lb	31.96	14.52
PG III	2.7	22.48 (5.62) lb	39.34	17.88

Appendix C

Packaging Data Sheet

Section I. Exterior Shipping Container

Packaging Category: ___ single _X_ combination ___ composite

UN Type: Fiberboard boxes (*49 CFR §178.516*) UN Code: 4G

Specification Type(s):
(1) Fabrication of Fiberboard Shipping Boxes
(2) Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes
(3) Box, Shipping, Fiberboard (canceled Mar 94)
(4) Fiberboard: Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes (canceled Mar 94)

Specification Number(s):
(1) ASTM D 5118, style RSC (regular slotted container)
(2) ASTM D 4727 (marked), grade V3c (marked), type CF, variety SW, class (domestic/weather-resistant) not marked
(3) Equivalent to-- PPP-B-636, style RSC [canceled Mar 94]
(4) Equivalent to-- PPP-F-320E, type CF (corrugated fiberboard), variety SW (singlewall), grade V3c, class (domestic/weather-resistant) not marked, [canceled Mar 94]

Container Manufacturer:
Lynchburg Sheltered Industries Lynchburg Sheltered Industries
Lynchburg, VA (boxmaker's seal) Lynchburg, VA 24501 (box flap)

Date of Manufacture: 12-96 (marked)

Manufacturer's Reference Number(s): N/A

Material: Corrugated fiberboard, glued manufacturer's joint
"bursting test 350 lbs per sq inch"
"min comb wt facings 180 lbs per sq in"
"size limit 100 inches"
"gross wt lt 120 lbs"

"min. avg. burst. stgth. in excess of ___ lbs. p.s.i." - N/A

NSN: 8115-00-183-9491 Tare Weight: 2.2 lb

Dimensions: 12 in. by 12 in. by 16 in. ID (marked)

RN: 00AYP036

Appendix C (Continued)

Section I. Exterior Shipping Container (continued)

Box Contract No.: Not marked Box Purchase Order No.: Not marked

Closure Specification(s): ASTM D 1974, Methods of Closing, Sealing, and Reinforcing Fiberboard Shipping Containers

Closure Type: Pressure-sensitive, film-backed tape

Closure Type Specification(s):
(1) Tested-- Commercial Item Description
Tape, Film, Pressure-Sensitive Adhesive, (Box Closure) [canceled Dec 95]
(2) Equivalent to-- FED SPEC
Tape: Packaging, Waterproof [canceled Dec 95]
(3) Equivalent to-- ASTM Specification for Pressure-Sensitive Tape for Packaging, Box Closure and Sealing

Closure Type Specification Number(s):
(1) A-A-1830A (marked) [canceled Dec 95]
(2) PPP-T-60, type III (film backing), class 2 (transparent) [canceled Dec 95]
(3) ASTM D 5486, type I (waterproof, weather-resistant, polyester-backed) class 2 (transparent)

Closure Type NSN: 7510-00-266-6715

Closure Method: Tape applied over all seams, corners, and joints of the box. Tape applied to the manufacturer's joint shall cover the joint, but not extend beyond the corners. The tape applied to the seams shall be centered over the seams and shall extend over the corners and edges of the box a minimum of 2½ inches onto the adjacent box panels

Closure Method Specification: ASTM D 1974 sealing method B; formerly method V, PPP-B-636 appendix (7-strip method)

Closure Dimensions: 2-inch (tape width)

Closure Manufacturer/Distributor:
American Tape, Secaucus, NJ (core marked)
SETAPE, INC., Jacksonville, FL (wrapper marked)

Closure Contract No.: GS-141-63159 (box marked)

Closure Purchase Order No.: A-W-LE486-9E (box marked)

Closure Date of Manufacture: 2/97 (marked)

Appendix C (Continued)

Section I. Exterior Shipping Container (continued)

Reinforcement Type(s): Tape Banding

Reinforcement Specification(s) and Number(s): ASTM D 1974, Methods of Closing, Sealing, and Reinforcing Fiberboard Shipping Containers

Reinforcement Specification Method No(s).: ASTM D 1974, modified Reinforcement Method 2B (see Reinforcement Method)

Reinforcement Method(s): Tape applied 1 inch from each end of the box. Bands shall overlap onto themselves at least 3 inches. Modifications-- 1-inch-wide tape used instead of ¾-inch-wide tape; four bands instead of one band; medium tensile tape used instead of high tensile tape

Banding Specification Type(s):
(1) Tested (marked)-- Commercial Item Description
Tape, Pressure-Sensitive Adhesive , (Medium Tensile Strength, Glass Filament, Reinforced Tape)
[canceled Jan 96]
(2) Equivalent to-- FED SPEC
Tape, Packaging/Industrial, Filament Reinforced
[canceled Jan 96]
(3) Equivalent to-- ASTM Standard Specification for
Pressure-Sensitive Tape for Packaging, Filament-Reinforced

Banding Specification Number(s):
(1) A-A-1687B, Amendment 1 (marked) [canceled Jan 96]
(2) PPP-T-97, type II (medium tensile),
class B (transparent) [canceled Jan 96]
(3) ASTM D 5330-93, type II (medium tensile)

Banding NSN: 7510-00-582-4772

Banding Position(s):
2 girthwise tape bands, *encircling top, bottom, and sides*,
1 inch in from each end
2 lengthwise tape bands, *encircling top, bottom, and ends*,
1 inch in from each side
0 horizontal tape bands, *encircling sides and ends*,
centered around the box body

Banding Dimensions: 1 inch wide

Banding Manufacturer(s): RJM MFG./TARA TAPE (box marked)
TARA TAPE (wrapper marked)
Fairless Hills, PA 19030
C-3

RN: 00AYP036

Appendix C (Continued)

Section I. Exterior Shipping Container (continued)

Banding Contract No.: TC-GS-14F-63238

Banding Purchase Order No.: A-W-LC337-5E

Banding Date of Manufacture: 12/96 (box marked)

Cushioning/Dunnage Specification Type(s):
Cellulose fiber-- HAZMATPAC® product A-900
Fiberboard-- Standard Specification for Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes

Cushioning/Dunnage Specification Number(s):
Cellulose fiber-- proprietary
Fiberboard-- recommended use of
ASTM D 4727, type CF (corrugated fiberboard)
variety SW (singlewall), C flute
class WR (weather-resistant)
grade V3c

Cushioning/Dunnage Dimensions: see Additional Description
Cellulose fiber-- ungraded, approximately 13 lb

Cushioning/Dunnage Manufacturer(s):
Cellulose fiber-- HAZMATPAC®
Fiberboard-- N/A

Static Electricity Protection: To be determined

Additional Description:

a. Two inches of absorbent material was placed in the bottom of the box. The bottle was placed on the absorbent meterial, and additional loose-fill absorbent material was then packed around and over the bottle. Two and one-half inches of absorbent material covered the bottle. Three inches of loose-fill absorbent material separated the bottle from the sides and ends of the box. The absorbent material must be firmly packed, especially into the box corners.

b. Before closing, the box was "shaken down" to settle the absorbent material. Additional absorbent material was added, as necessary to make a tight pack.

Appendix C (Continued)

Section I. Exterior Shipping Container (continued)

c. The quantities of absorbent material DOES meet the guidelines for absorbent material outlined in AFJMAN 24-204/TM 38-250/NAVSUP PUB 505/MCO P4030.19F/DLAM 4145.3, Preparing Hazardous Materials for Military Air Shipments.

d. Care must be exercised when selecting absorbent material to avoid introducing water or surfactants (treatments to reduce dust) into the package. Only untreated absorbent material should be used.

e. Before cancellation, PPP-B-636 specified that *horizontal* reinforcing tape bands *(encircling the box sides and ends)*, are not required when the box depth (height) is less than but not equal to 18 inches. Experience has demonstrated that glued manufacturers' joints have potential to fail if horizontal reinforcing tape banding is not applied.

f. Before cancellation, PPP-B-636 specified that one *girthwise*

reinforcing tape band *(encircling the box top, bottom, and sides)*, is required when the box length is less than but not equal to 20 inches. Reinforcing tape bands in the girthwise direction were not used per instructions from the requesting organization.

g. Before cancellation, PPP-B-636 specified that one *lengthwise* reinforcing tape band *(encircling the box top, bottom, and ends)*, is required when the box width is greater than 9 inches and less than 18 inches. Reinforcing tape bands in the lengthwise direction were not used per instructions from the requesting organization.

h. ASTM D 1974 recommends that, when used, tape bands shall be placed around the girth (smallest circumference) of the box with at least one band for each 15 inches of box length.

i. Prior to 3 March 1994, PPP-B-636 specified the construction, closing, and reinforcing of fiberboard boxes, while PPP-F-320 specified the fiberboard. Both FED SPECs have been canceled and replaced with ASTM documents. ASTM D 4727 is the specification for fiberboard; ASTM D 5118 is the practice for fabricating fiberboard boxes; and ASTM D 1974 is the practice for closing, sealing, and reinforcing fiberboard boxes. The three ASTM documents almost mirror the two FED SPECs with the most notable exception being that PPP-B-636 provided tables for when and what size reinforcement was to be specified. ASTM D 1974 does not recommend comparable reinforcements.

Appendix C (Continued)

Section II. Inner Packaging of Combination Packaging Applicable/~~Not applicable~~

Quantity of Inner Containers: 1

Capacity: 2½-liters each (80 oz., marked)

Specification Type and No(s).: N/A NSN: N/A

Type: Round, flint glass, screw-cap bottle with handle

Manufacturer/Distributor:
Codes embossed on bottom-- 17 0 78 3
Scientific Specialties Service, Hanover, Maryland, P/N F73580

Material(s): Flint glass Date(s) of Manufacture: N/A

Tare Weight (empty bottle): 2.15 lb; (976.06 g)

Filled Weight: ~7 lb ea

Dimensions: 12 in. high; 5? in. diameter (OD)

Closure (Method/Type): Plastic screw cap, foam-lined

Closure Specification Number(s): N/A

Closure Dimensions: 1¼ in. in diameter (OD)
1½ in. in height (OD)

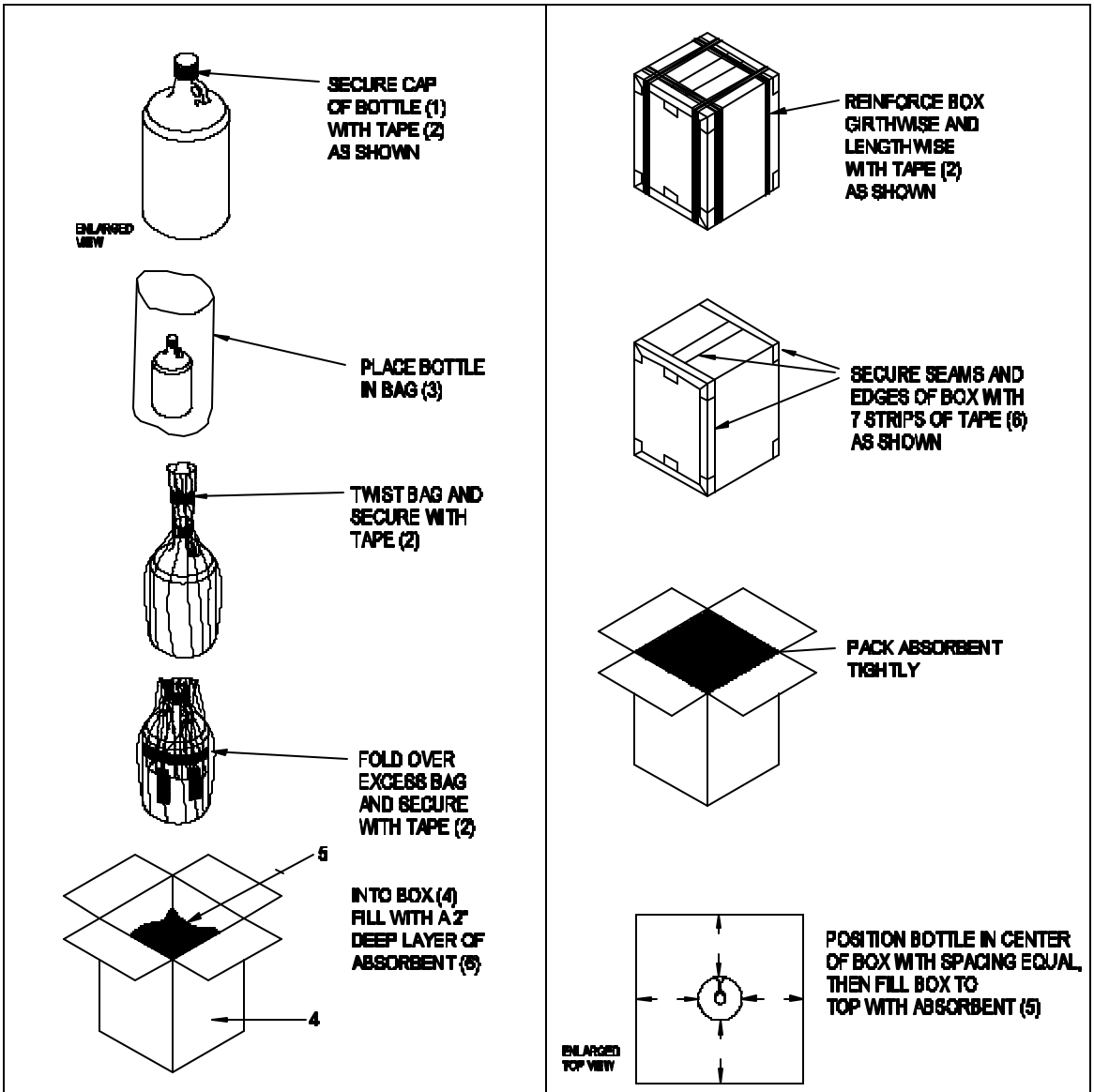
Closure Manufacturer: N/A

Secondary Closure: Filament-reinforced tape (2 pc)

Secondary Closure Specification(s):
(1) Tested (marked-- Commercial Item Description
Tape, Pressure-Sensitive Adhesive, (Medium Tensile
Strength, Glass Filament, Reinforced Tape)
[canceled Jan 96]
(2) Equivalent to-- FED SPEC
Tape, Packaging/Industrial, Filament Reinforced
[canceled Jan 96]
(3) Equivalent to-- ASTM Standard Specification for
Pressure-Sensitive Tape for Packaging, Filament-Reinforced

Secondary Closure Dimensions: N/A

Section III. Drawing



ITEM	DESCRIPTION 0AYP036D
1	2-1/2 LITER, FLINT GLASS, ROUND, SCREW CAP BOTTLE WITH HANDLE, QTY. 1
2	1-INCH WIDE, PRESSURE-SENSITIVE TAPE, FILAMENT-REINFORCED, IAW ASTM D5330, TY II
3	PLASTIC BAG, 4-MIL POLYETHYLENE
4	FIBERBOARD BOX, ASTM D5118, STYLE RSC, GRADE V3c, NSN: 8115-00-418-4653, 12X12X16 IN.
5	CELLULOSE FIBER ABSORBENT, OR VERMICULITE, A-A-52450
6	2-INCH WIDE, PRESSURE-SENSITIVE TAPE, IAW ASTM D 5486, TY II, NSN: 7510-00-266-6715

Appendix D

Rationale

The equivalent of Packing Group I (great danger) testing was requested for a 12- by 12- by 16-inch corrugated fiberboard box having as the intended contents one 2½-liter, round, glass bottle, with screw cap. The configuration to be tested is intended to be applicable to a large assortment of liquid products contained in screw-cap, round, glass bottles, in volumes of 2½-liter, 2-liter, 1-liter, or less. For lesser volumes, variations to testing requirements can be found in
49 CFR §178.601(g).

For testing, substitution for the actual hazardous lading is permitted by 49 CFR §178.602(c). Water can be used as a substitute liquid.

One combination packaging made to the above described configuration was subjected to drop and vibration testing as prescribed in ASTM D 4919. These tests are designed to simulate the shock and vibration a package (configuration) may encounter when being shipped worldwide by truck, rail, or ocean going transport. The order of testing was vibration, then drop testing. Prior to the rough handling testing of the packed box, static loading was performed on the empty box. This is a U.S. DOT approved method of stack testing, especially when the combination packaging has wide applications. A separate box was used for water absorptiveness testing of the fiberboard.

In conducting the drop test, all five drops (flat bottom, flat top, flat long side, flat short side, and manufacturer's joint bottom corner) were performed on the same configuration. The decision to use the same container (configuration) for all five drop orientations was based on the relatively minimal damage demonstrated during previous testing of grade V3c, class weather-resistant, corrugated fiberboard boxes with different inner containers. It should be noted that five drops per box exceeds 49 CFR requirements. One drop per box is the **minimum** per 49 CFR requirements (49 CFR §178.603(a)), as well as, per both UN and ASTM recommendations (i.e., one drop on a side or corner per box). The use of one configuration for multiple tests and drops is DOD policy as stated in DLAD 4145.41/AR 700-143/AFJI 24-201/NAVSUPINST 4030.55A/MCO 4030.40A, Packaging of Hazardous Material. Also per this policy, any failed orientation(s) can be repeated using another configuration.

Appendix D (Continued)

Due to the variety of items to be packaged, testing was actually conducted according to the parameters for dense liquids (those with specific gravity up to 1.8) belonging to Packing Group II. This would equate to rough handling tests equivalent to those for Packing Group I for liquids having a specific gravity of 1.2 or less, and for Packing Group III liquids having specific gravity 2.7 or less.

For the drop test (*49 CFR §178.603*), a free fall drop table, set for 1.8 meters (71 in.), was used. The impact surface was the ½-inch steel impact plate of the table, which was bolted to the concrete floor.

For the stack test (*49 CFR §178.606*), a 500-lb constant force was used as a static top load, because it could hold the load constant for the required 24-hour timeframe. The minimum total top load to be applied was computed based on the density of the heaviest liquid anticipated at 98% of maximum capacity, and the outer box height. The top load was to simulate a stack of identical packagings which might be stacked on the packaging during transport. The minimum height of the stack could not be less than 3 meters (118 in.), so the number of packagings (stack height minimum divided by assembled box height) had to be represented by an integer number, which had to be rounded up, without respect to which was the nearest whole number.

The leakproofness test of the glass bottle is not required, because the bottle is an inner packaging in a combination packaging.

The hydrostatic pressure test (*49 CFR §178.605*) is a test to be performed for single packagings, and is not required for inner packagings of combination packagings. The hydrostatic pressure test of a glass bottle is not required.

As required by the standards for fiberboard boxes (*49 CFR §178.516*), the Cobb Method Test for water absorptiveness was performed on specimens cut from a box taken from the same bundle as the box used for rough handling (drop, stack, and vibration) testing. This test was performed per TAPPI Method T 441. The apparatus used was a commercially available Cobb Sizing Tester. The volume of deionized water was computed to maintain an equivalent head of 1.0 $\pm$ 0.1

centimeter. Since boxes are occasionally made with the wire facing (interior) as the exterior side of the box, specimens from both the wire (interior) and the felt (exterior) facings were tested for water absorptiveness. It should be noted that improper storage and rough handling can break the fibers and abrade the coating, decreasing the ability to resist water absorption. This could result in higher test values.

Appendix D (Continued)

The vibration test (*49 CFR §178.608*), utilizing a 2,000-lb capacity vibration table, was performed to be in compliance with U.S. Department of Transportation standards for packagings bearing the United States mark (USA) as a component of the packaging certification marking (*49 CFR §173.24a(a)(5)*). The test was conducted as prescribed by ASTM D 999, method A2 (Repetitive Shock Test (Rotary Motion)). Testing was conducted as a means to determine capability. The test was run for 1 hour.

Compatibility testing (a procedure specified in appendix B to part 173, as required by *49 CFR §173.24(e)(3)(ii)*) is only required for plastics packagings intended to contain liquid hazardous materials.